

1 27.(new) An internal combustion engine machine incorporating significant  
2 improvements in power, efficiency and emissions control comprising:

3  
4 (a) one or more cylinders, each comprising at least one head,  
5 combustion chamber, base, compression chamber and sidewall;

6  
7 (b) one or more means of igniting fuel in the cylinder(s);

8  
9 (c) one or more sources of intake air;

10  
11 (d) at least one means of storing and/or cooling lubricating oil  
12 between cycles of circulation;

13  
14 (e) a drive train;

15  
16 (f) at least one means of encasing, protecting, cooling and  
17 lubricating the drive train;

18  
19 (g) at least one means of segregating the oil in the sump and/or  
20 crankcase from the air or air/fuel mixture in the cylinder, whether within or apart  
21 from the combustion chamber.

22  
23 (h) at least one means of dispersing oil on the cylinder walls and of  
24 then gathering excess for return to the oil sump;

25  
26 (i) at least one means of transmitting energy to and from the  
27 pistons;

1 (j) at least one means of guiding each piston rod such that it moves  
2 in a linear manner, always along substantially the same line;

3

4 (k) at least one means of drawing air or air/fuel mixture into the  
5 engine machine, propelling it into the cylinder combustion chamber, compressing  
6 it for ignition and propelling its expulsion after ignition;

7

8 (l) at least one means of admitting air and fuel, or air/fuel mixture  
9 into each cylinder apart from the combustion chamber;

10

11 (m) at least one means of efficiently expelling exhaust gases  
12 resulting from combustion of the air fuel mixture after energy has been extracted;

13

14 (n) at least one means of transmitting energy from the piston rod to  
15 the drive train;

16

17 (o) at least one means of cooling the engine; and

18

19 (p) at least one means of transporting dispersing gathering and  
20 returning lubricating/cooling oil while keeping it segregated from combustion air  
21 and fuel;

22

23 (q) wherein the means of efficiently expelling exhaust gases upon  
24 completion of combustion and energy extraction comprises a cylinder head  
25 exhaust valve, allowing exhaust to exit through the head of the cylinder.

26

1 28.(new) An internal combustion engine machine incorporating significant  
2 improvements in power, efficiency and emissions control comprising:

3  
4 (a) one or more cylinders, each comprising a head, a combustion  
5 chamber, a base, a compression chamber and a sidewall;

6  
7 (b) one or more means of igniting fuel in the cylinder(s);

8  
9 (c) one or more sources of intake air;

10  
11 (d) at least one means of storing and/or cooling lubricating oil  
12 between cycles of circulation;

13  
14 (e) a drive train;

15  
16 (f) at least one means of encasing, protecting, cooling and  
17 lubricating the drive train;

18  
19 (g) at least one means of segregating the oil in the sump and/or  
20 crankcase from the air or air/fuel mixture in the cylinder, whether within or apart  
21 from the combustion chamber.

22  
23 (h) at least one means of dispersing oil on the cylinder walls and of  
24 then gathering excess for return to the oil sump;

25  
26 (i) at least one means of transmitting energy to and from the  
27 pistons;

1 (j) at least one means of guiding each piston rod such that it moves  
2 in a linear manner, always along substantially the same line;

3  
4 (k) at least one means of drawing air or air/fuel mixture into the  
5 engine machine, propelling it into the cylinder combustion chamber, compressing  
6 it for ignition and propelling its expulsion after ignition;

7  
8 (l) at least one means of admitting air and fuel, or air/fuel mixture  
9 into each cylinder apart from the combustion chamber;

10  
11 (m) at least one means of efficiently expelling exhaust gases  
12 resulting from combustion of the air fuel mixture after energy has been extracted;

13  
14 (n) at least one means of transmitting energy from the piston rod to  
15 the drive train;

16  
17 (o) at least one means of cooling the engine;

18  
19 (p) at least one means of transporting, dispersing, gathering, and  
20 returning lubricating/cooling oil while keeping it segregated from combustion air  
21 and fuel; and

22  
23 (q) at least one means of collecting, storing, and transferring inertial  
24 energy from one drive stroke to another, comprising at least one inertial mass or  
25 flywheel.

1 29.(new) An internal combustion engine machine incorporating significant  
2 improvements in power, efficiency and emissions control comprising:

3  
4 (a) one or more cylinders, each comprising at least one head,  
5 combustion chamber, base, compression chamber and sidewall;

6  
7 (b) one or more means of igniting fuel in the cylinder(s);

8  
9 (c) one or more sources of intake air;

10  
11 (d) at least one means of transporting dispersing gathering and  
12 returning lubricating and ,or, or, cooling oil;

13  
14 (e) at least one means of storing and/or cooling lubricating oil  
15 between cycles of circulation;

16  
17 (f) at least one means of dispersing lubricating oil on the cylinder  
18 walls and of then gathering excess for return to an oil sump;

19  
20 (g) at least one means of segregating lubricating oil from the  
21 combustion air or air/fuel mixture, and combustion products at substantially all  
22 points in the engine.

23  
24 (h) at least one drive train;

25  
26 (l) at least one means of, protecting, cooling and, or, or, lubricating  
27 the drive train;

1 (j) at least one means of transmitting energy to and from the  
2 pistons;

3  
4 (k) at least one means of guiding each piston rod such that it  
5 moves in a linear manner, always along substantially the same line;

6  
7 (l) at least one means of drawing air or air/fuel mixture into the  
8 engine machine, of propelling it into the cylinder combustion chamber, of  
9 compressing it for ignition, and of propelling its expulsion after ignition;

10  
11 (m) at least one means of admitting air, fuel, or an air/fuel mixture  
12 into each cylinder; apart from the combustion chamber.

13  
14 (n) at least one means of expelling exhaust gases resulting from  
15 combustion of the air fuel mixture after energy has been extracted;

16  
17 (o) at least one means of transmitting energy from the piston rod to  
18 the drive train;

19  
20 (p) at least one means of cooling the engine; and

21  
22 (q) at least one means of expelling exhaust gases upon completion  
23 of combustion and energy extraction comprising at least one cylinder head  
24 exhaust valve, allowing exhaust to exit through the head of the cylinder.

1 30. (new) An internal combustion engine machine as in claim 27 comprising at  
2 least one plurality of cylinders in one or more banks of two opposing cylinders  
3 each.

4  
5 31. (new) An internal combustion engine machine as in claim 27 wherein the  
6 means of transmitting energy to and from the each piston comprises;

7  
8 (a) at least one piston-rod with a piston attached at one end;

9  
10 (b) each piston rod passing through the base of its cylinder,  
11 carrying the force of its associated piston power stroke to the drive train;

12  
13 (c) the piston rod linked to the drive shaft by at least one push rod  
14 in the crankcase/oil sump, propelling at least one transmission mechanism,  
15 comprising at least one crank-plate, or other rotary, or linier device powering at  
16 least one drive shaft.

17  
18 32. (new) An internal combustions engine machine as in claim 27 wherein the  
19 means of cooling the engine comprises exhaust gas expansion, cooling fins and  
20 at least one volume of oil circulated through the cylinders and pooled in the  
21 sump, the sump acting as at least one heat sink for oil circulating from the  
22 cylinders.

23  
24 33. (new) An internal combustion engine machine as in claim 27 wherein the  
25 means of transmitting energy from the piston rod to the drive train comprises at  
26 least one rotary device, linked to the piston rod by at least one push rod.

1 34. (new) An internal combustion engine machine in claim 27 in which the means  
2 of transmitting energy from the piston rod to the drive train comprises at least  
3 one rack and pinion transmission system, segmented gear drive, or ratchet  
4 device.

5  
6 35. (new) An internal combustion engine machine as in claim 27 wherein the  
7 means of admitting the fuel component of the air/fuel mixture into each cylinder  
8 comprises at least one fuel injector for each cylinder.

9  
10 36. (new) An internal combustion engine machine as in claim 27 wherein the  
11 means of admitting air or air/fuel mixture into each cylinder obtained by intake  
12 ports in the sidewall of each cylinder.

13  
14 37. (new) An internal combustion engine machine as in claim 27 wherein the  
15 means of efficiently expelling exhaust gases upon completion of combustion and  
16 energy extraction comprises at least one cylinder head exhaust valve, allowing  
17 exhaust to exit through the head of the cylinder.

18  
19 38. (new) An internal combustion engine machine as in claim 27 wherein a  
20 means of drawing air or air/fuel mixture into the system, propelling it into the  
21 cylinder combustion chamber, compressing it for ignition and expelling it after  
22 ignition comprises at least one multi-function piston, that:

23  
24 (a) on upstroke, draws air from an intake source and into an  
25 intake/compression chamber beneath the piston, at the same time, compressing  
26 an air/fuel mixture in the cylinder combustion chamber above the piston, and  
27 then,



1 (b) on down stroke, following combustion of the air/fuel mixture,  
2 compresses and propels scavenge air out of the intake/compression chamber  
3 below the piston, and into the cylinder combustion chamber above the piston,  
4 then,

5  
6 (c) on the following up-stroke, expels the scavenge air and  
7 remaining exhaust from the combustion chamber, at the same time drawing  
8 combustion air or a combustion air/fuel mixture into an intake/compression  
9 chamber below the piston, then,

10  
11 (d) on the following down stroke; compresses and propels the  
12 combustion air or air/fuel mixture, out of the intake/compression chamber below  
13 the piston, and into the cylinder combustion chamber above the piston, for  
14 combustion, completing a cycle.

15  
16 39. (new) An internal combustion engine machine as in claim 27 wherein a  
17 means of drawing air or air/fuel mixture into the system, propelling it into the  
18 cylinder combustion chamber, compressing it for ignition and expelling it after  
19 ignition comprises a two stroke process wherein at least one multi-function  
20 piston:

21  
22 (a) on a single up stroke, draws combustion air or air/fuel mixture  
23 from the intake source and into an intake/compression chamber beneath the  
24 piston, and compresses the air or air/fuel mixture in the combustion chamber,  
25 then,

1 (b) upon combustion, on a single down stroke, propels combustion  
2 air or air fuel mixture out of the compression chamber into a cylinder combustion  
3 chamber above the piston, at the same time expelling the exhaust from the  
4 combustion chamber and completing the combustion/exhaust cycle.

5  
6 40. (new) An internal combustion engine machine as in claim 27 wherein the  
7 means of guiding each piston rod such that it moves in a linear manner, always  
8 along substantially the same line, comprises at least one compression wall and  
9 at least one piston rod compression seal, the compression seal serving as a  
10 piston rod guide to hold each piston in correct position within its cylinder.

11  
12 41. (new) An internal combustion engine machine as in claim 27 wherein there is  
13 provided for each cylinder, at least one multi-function piston performing in four  
14 strokes, intake, compression, combustion, exhaust and power functions plus  
15 lubrication, these comprising, to:

16  
17 (a) draw in new combustion air or air/fuel mixture into an  
18 intake/compression chamber, separate from the cylinder combustion chamber,

19  
20 (b) compress and propel the new air or air/fuel mixture from the  
21 intake/compression chamber, into the cylinder combustion chamber,

22  
23 (c) compress the air/fuel mixture in the cylinder combustion  
24 chamber,

25  
26 (d) draw in scavenge air into an intake/compression chamber,  
27 separate from the cylinder combustion chamber,

1 (e) receive the force of combustion for transmission to the piston  
2 rod,

3

4 (f) compress and propel the scavenge air from the  
5 intake/compression chamber, into the cylinder combustion chamber,

6

7 (g) compress and propel the scavenge air and combustion by-  
8 products from the cylinder combustion chamber as exhaust, and

9

10 (h) receive, disperse and recoup lubricating oil for return to the oil  
11 sump/cooler.

12

13 42. (new) An internal combustion engine machine as in claim 27 wherein there is  
14 provided for each cylinder, at least one multi-function piston performing, in two  
15 strokes, intake, compression, combustion, exhaust and power functions plus  
16 lubrication, these comprising, to:

17

18 (a) in a single upstroke, draw new combustion air or air/fuel mixture  
19 into an intake/compression chamber, separate from a cylinder combustion  
20 chamber, and in the same action, compress an air/fuel mixture in the cylinder  
21 combustion chamber,

22

23 (b) receive the force of combustion for transmission to the piston  
24 rod,

25

26 (c) in a single down-stroke, upon combustion in the cylinder  
27 combustion chamber, compress and propel the new air or air/fuel mixture from

1 the intake/compression chamber, into the cylinder combustion chamber, and in  
2 the same action, scavenge and exhaust combustion by-products from the  
3 cylinder combustion chamber, and,  
4

5 (d) receive, disperse and recoup lubricating oil for return to the oil  
6 sump/cooler.  
7

8 43. (new) An internal combustion engine machine as in claim 27 wherein the  
9 means of dispersing oil on the cylinder walls and of then gathering excess for  
10 return to the oil sump comprises oil hoarding rings, at least one ring located near  
11 the head and base of at least one piston, such that the rings contain any oil  
12 dispersed between them, and when in motion, push said oil before them,  
13 substantially wiping it off the cylinder walls as they move.  
14

15 44. (new) An internal combustion engine machine as in claim 27 wherein a  
16 means of segregating the oil in the sump and/or crank case from the air or  
17 air/fuel mixture in the cylinder comprises at least one compression wall and  
18 piston rod pressure seal at the base of at least one cylinder;  
19

20 (a) the compression wall segregating the fuel, air, or combustion  
21 by-products in at least one cylinder from the lubricating, and, or, or, oil in the oil  
22 sump/crankcase, thus creating at least one segregated and sealed intake  
23 chamber into which the air or fuel/air mixture is first received from the carburetor,  
24 breather, or other combustion air source, and from which it is discharged into the  
25 cylinder combustion chamber; and  
26

1 (b) a piston rod passing through the compression wall at the base  
2 of each corresponding cylinder and into the sump/crankcase by way of the  
3 compression wall and pressure seal.

4  
5 45. (new) An internal combustion engine machine as in claim 27 wherein a  
6 means of encasing, protecting, and lubricating the drive train comprises at least  
7 one combination crankcase, and, or, or, oil sump;

8  
9 46. (new) An internal combustion engine machine as in claim 27 wherein a  
10 means of storing and/or cooling the oil between cycles of circulation comprises at  
11 least one combination crankcase/oil sump;

12  
13 47. (new) An internal combustion engine machine as in claim 27 wherein a  
14 source of intake air comprises at least one carburetor;

15  
16 48. (new) An internal combustion engine machine as in claim 27 wherein a  
17 means of igniting the fuel comprises an electrical spark;

18  
19 49. (new) An internal combustion engine machine as in claim 27, wherein a  
20 means of transporting, dispersing, gathering and returning lubricating, and, or,  
21 or, cooling oil while keeping it segregated from combustion air and fuel  
22 comprises;

23  
24 (a) at least one dynamic force lubricating oil pump comprising at  
25 least one piston rod/lubrication assembly that serves as both at least one means  
26 of transmitting force to and from the piston and as at least one means to transmit

1 lubricating/cooling oil to as associated cylinder via at least one multi-function  
2 piston assembly;

3  
4 (b) at least one multi-function-piston assembly comprising at least  
5 one piston rod with at least one multi-function piston attached to either or each  
6 end, and having one or more oil pick-up and exhaust ports in its mid section, and  
7 one or more oil transport passages in the piston rod from the oil pick-up nozzles  
8 to the multi-function-piston and back to the oil exhaust ports;

9  
10 (c) each multi-function-piston comprising one or more  
11 radially situated oil inlet and outlet ports that distribute lubricating oil to the  
12 associated cylinder and recover the oil for return to the sump/crankcase,  
13 and each multi-function piston also comprising;

14  
15 (d) at least one oil hoarding ring near each piston head and  
16 base to assist in dispersing and then re-gathering the oil for return to a  
17 sump such that oil flows through the piston rod and piston, and around the  
18 piston, lubricating and cooling piston walls, piston rings and cylinder walls,  
19 and returns through the piston and piston rod to the oil sump.

20  
21 50. (new) An internal combustion engine machine as in claim 27 wherein at least  
22 one wrist pin links each piston to its piston rod.

23  
24 51. (new) An internal combustion engine machine as in claim 27 wherein a  
25 means of igniting fuel in the cylinders comprises explosive compression in the  
26 cylinder head.

1 52. (new) An internal combustion engine machine as in claim 27 wherein a  
2 means of igniting fuel in the cylinders comprises at least one glow plug.

3  
4 53. (new) An internal combustion engine machine as in claim 27 wherein a  
5 means of igniting fuel in the cylinders comprises at least one electrical spark.

6  
7 54. (new) An internal combustion engine machine as in claim 28 wherein a  
8 means of transmitting energy to and from the pistons comprises at least one  
9 piston-rod between and joining each pair of pistons in each cylinder bank such  
10 that each piston rod has a piston at each end,

11  
12 (a) each piston rod passing through the base of its associated  
13 cylinder, each piston rod carrying the force of its associated piston power stroke  
14 to the drive train, and across to the opposite associated piston, thereby,  
15 powering that piston's compression stroke, and

16  
17 (b) at least one piston rod linked, directly or indirectly, to a drive  
18 shaft, via at least one rotary or linier energy transmission device.

19  
20 55. (new) An internal combustion engine machine as in claim 28 comprising at  
21 least one plurality of banks of cylinders, each bank comprised of two or more  
22 cylinders and the drive train of each bank joined to the drive train of its  
23 neighboring bank(s) in such a way that each bank may be independently  
24 disconnected from its neighbor(s) and shut down automatically or at the  
25 discretion of the operator, the manner of joining the bank drive trains being, in  
26 example, manual clutch(es), centrifugal clutch(es), or ratchet devices.

1 56. (new) An internal combustion engine machine incorporating significant  
2 improvements in power, efficiency and emissions control comprising;

3  
4 (a) one or more cylinders, each comprising at least one head,  
5 combustion chamber, base, compression chamber and sidewall;

6  
7 (b) one or more means of igniting fuel in the cylinder(s);

8  
9 (c) one or more sources of intake air;

10  
11 (d) at least one means of storing and/or cooling lubricating oil  
12 between cycles of circulation;

13  
14 (e) a drive train;

15  
16 (f) at least one means of encasing, protecting, cooling and  
17 lubricating the drive train;

18  
19 (g) at least one means of segregating the oil in the sump and/or  
20 crankcase from the air or air/fuel mixture in the cylinder;

21  
22 (h) at least one means of dispersing oil on the cylinder walls and of  
23 then gathering excess for return to the oil sump;

24  
25 (i) at least one means of transmitting energy to and from the  
26 pistons;



1 (j) at least one means of guiding each piston rod such that it moves  
2 in a linear manner, always along substantially the same line;

3  
4 (k) at least one means of drawing air or air/fuel mixture into the  
5 engine machine, propelling it into the cylinder combustion chamber, compressing  
6 it for ignition and propelling its expulsion after ignition;

7  
8 (l) at least one means of admitting air and fuel, or air/fuel mixture  
9 into each cylinder;

10  
11 (m) at least one means of efficiently expelling exhaust gases  
12 resulting from combustion of the air fuel mixture after energy has been extracted;

13  
14 (n) at least one means of transmitting energy from the piston rod to  
15 the drive train;

16  
17 (o) at least one means of cooling the engine; and

18  
19 (p) at least one means of transporting, dispersing, gathering, and  
20 returning lubricating/cooling oil while keeping it segregated from combustion air  
21 and fuel;

22  
23 (q) wherein, the means of transporting, dispersing, gathering and  
24 returning lubricating/cooling oil while keeping it segregated from combustion air  
25 and fuel comprises at least one dynamic force lubricating oil pump comprising;

1 (r) at least one piston rod/lubrication assembly that serves  
2 both as at least one means of transmitting force to and from the piston  
3 and as at least one means to transmit lubricating/cooling oil to and from its  
4 cylinder in concert with at least one multi-function piston;

5  
6 (s) the piston rod/lubrication assembly comprising at least  
7 one piston rod with a multi-function piston attached to each end, oil pick-  
8 up nozzles and exhaust ports in its mid section, and oil transport  
9 passages in the piston rod from the oil pick-up nozzles to the multi-  
10 function piston and back to the oil exhaust ports;

11  
12 (t) the multi-function piston comprising at least one  
13 piston configured with one or more radially situated oil inlet and  
14 outlet ports that distribute lubricating oil received from the piston  
15 rod/lubrication assembly, to the associated cylinder, and that  
16 recover the oil for return to the sump/crankcase via the piston  
17 rod/lubrication assembly; and

18  
19 (u) the multi-function-piston assembly also comprising oil hoarding  
20 rings near each piston head and base to assist in dispersing and then re-  
21 gathering the oil for return to the cooling, sump such that oil flows through the  
22 piston rod and piston, and around the piston, and returns through the piston and  
23 piston rod to the oil sump/crank case.

24  
25 **REMARKS**

26 Paragraph (3) In respectful response to examiner's comments proposing  
27 withdrawal of claim 7 and 8, proposing rejection of claims 1-6, 9, 11-20, and 22-  
28 26, and offering allowance of claims 10 and 21 if rewritten in accordance with